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JC20 Rec'd PCT/PTO 30 JUN 2005

A DEVICE FOR A PULLING TOOL FOR USE IN PIPES AND BOREHOLES  
FOR THE PRODUCTION OF OIL AND GAS

This invention relates to a pulling tool, in particular for  
use in the positioning of equipment and acquisition of meas-  
5 ured data in pipelines and boreholes for the production of  
oil and gas.

In long pipelines and boreholes there is often a need for  
putting down different equipment and collect measured data.  
For this purpose pulling tools of different embodiments are  
10 used, having wheels or chains that roll on the wall of the  
pipe or borehole. The rollers or the chain are/is pressed  
against the wall of the pipe/borehole with a force sufficient  
to achieve the desired axial propulsive force in varying  
frictional conditions. The supply of power is effected  
15 through a cable connection to the surface.

An optimum pulling tool must be formed to be able to negoti-  
ate restrictions and sharp curvatures without getting stuck.  
In order to achieve these important functions, a solution has  
been reached in the present invention, which makes it possi-  
20 ble in a simple and robust way to meet these functional re-  
quirements. To achieve this object the pulling tool is pro-  
vided with 3 axially longitudinal chains, offset 120 degrees

relative to each other viewed in a section perpendicular to the longitudinal axis. The chains run on longitudinal links which are interlocked, so that the radial movement will be the same for all three chains when they are moved radially. 5 With this construction is achieved that the pulling tool is always kept centred within a pipe or a borehole. This is a condition for allowing efficient positioning of equipment and operation of measuring tools.

10 A limitation in the length of the tool is achieved by all three links with chains being arranged in such a way that they have a radial movement out from the centre. In addition, the links are arranged 120 degrees offset relative to each other and with the same extent longitudinally. In most other known structures the pulling devices are arranged one behind 15 the other, which makes the pulling tool long and unsuitable in sharp curvatures. In boreholes which have not been lined with steel pipes, the walls are often rough and it is difficult for wheels to achieve sufficient grip. In such events the use of chains would be advantageous.

20 Most known pulling tools utilize electric/hydraulic operation. This means that an electric motor drives a hydraulic pump, which again supplies power to hydraulic motors in the driving wheels. Such a system will be technically complex and low efficiency is achieved. With a limited supply of power 25 through long cables, this will limit the traction substantially. In several operations great tractive power is desirable. In the present invention propulsion is effected through direct electric drive, without the use of hydraulics. Thereby a substantially higher performance is achieved for the pulling 30 tool.

The invention will now be explained in further detail in connection with a description of an exemplary embodiment and with reference to drawings, in which:

Figure 1 shows the pulling tool with chains and links in the extended position;

Figure 2 shows section A-A through a link with chain guides;

Figure 3 shows a chain detail;

5 Figure 4 shows the mounting of links;

Figure 5 shows a detail of the mounting for links;

Figure 6 shows a detail of a drive arrangement for chains;

Figure 7 shows a section of a borehole with the pulling tool in an extended position against the wall of the borehole.

10 The main structure of the tool consists of an elongate, cylindrical element (1). To this cylindrical element are arranged links (2), (4) and (5) connected with linkages (6). The links can be moved radially in milled grooves (11) in the main element (1) in such a way that the links (2) are forced  
15 against the borehole wall (20) in a position parallel to the longitudinal axis of the main part (1). Radial displacement of the links (2) is brought about by the terminal element (9), to which the links (5) are connected, being moved axially. To obtain the greatest possible radial force against  
20 the borehole wall, the links (5) are terminated at the terminal element (9) through the bolt (12) in a bolt hole (10) at a distance (14) on the opposite side of the centre line (13). A corresponding termination is made for all three end links (5) placed 120 degrees offset from each other. Axial movement  
25 for the activation of the links (5) through the terminal element (9) is effected by an actuator (24) and a spring element (7) placed between the actuator and the terminal element (9). The supply of energy to the actuator and the driving of the

chains (3) is effected through a cable connection (23) from the surface.

5 The chain (3) is made up of side links (21) with rollers (22) held in place by through bolts (26). The chain runs in milled grooves (27) in the links and across pulleys (25) and driving wheels (15).

10 The driving of the chains (3) is provided by three chain wheels (15) arranged to a bevel gear (17) engaging the bevel gear (18) connected to the shaft (19). The shaft (19) communicates with the electric motor (8), so that the electric motor is mechanically connected to the chain wheel (15) for direct mechanical drive of the chains (3).

## C l a i m s

1. A pulling tool for use in pipelines and boreholes including an elongated body (1) and at least one in relation to the centre axis (13) of the elongated body (1) radially displaceable first link (2), the first link (2) being substantially parallel to the centre axis (13), in that a chain (3) which constitutes a propulsion chain, is located between the first link (2) and the borehole wall (20), and where one end party of the first link (2) is hingedly connected to the elongated body (1) by a second link (4), and where the opposite end portion of the first link (2) is hingedly connected to the elongated body (1) by a third link (5) and an in relation to the elongated body (1) axially displaceable terminal element (9), characterized in that a hinge pin (12) connecting the third link (5) to the terminal element (9) is positioned on the opposite side of the centre axis (13) relative the first link (2).
2. Pulling tool as described in claim 1, characterized in that the terminal element (9) is connected to a preloaded spring element (7) whereby the first link (2) is preloaded towards the borehole wall (20) through the third link (5).

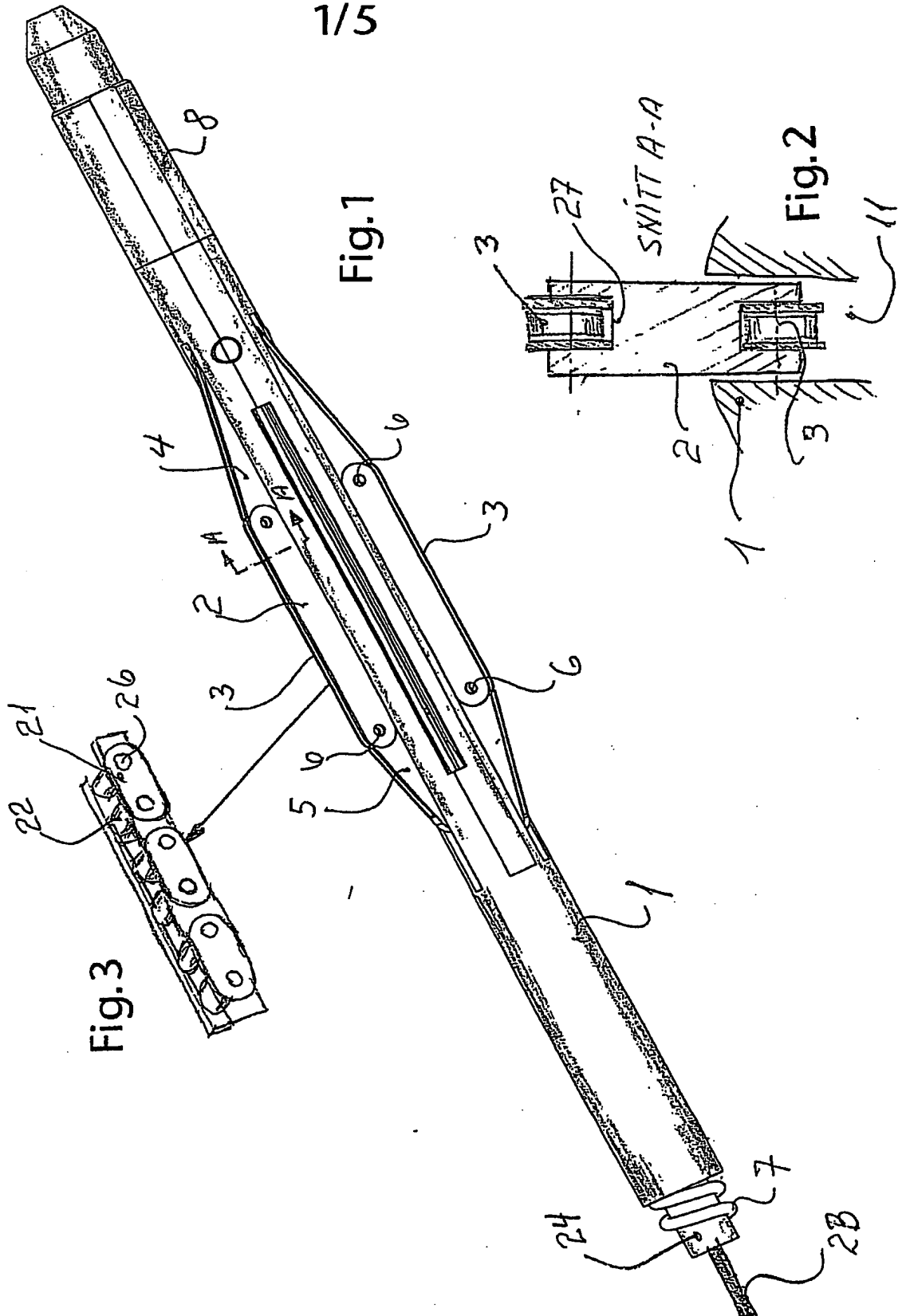
AMENDED SHEET

## A B S T R A C T

A pulling tool for use in the placing of equipment and acquisition of data from pipes and boreholes used in the production of oil and gas. For this purpose the tool is constructed  
5 round a central, elongate, cylindrical main element (1) to which there are arranged radially movable links (2), (4) and (5) with chains (3) arranged thereto, running in grooves (11). Radial movement of the links is provided by subjecting a terminal element (9) for the links (5) to an axial movement  
10 by means of an actuator (24). The chains (3) are rotated by an electric motor (8) transferring, through the axle (9) connected to the bevel gears (18) and (17), propulsive force to the chain wheel (15) on which the chains (3) are running.

Inventor(s): Geir Ueland et al.  
Attorney Docket No. 1935-00166

1/5



A DEVICE FOR A PULLING TOOL FOR USE IN PIPES AND BOREHOLES  
FOR THE PRODUCTION OF OIL AND GAS (as amended)

Inventor(s): Geir Ueland et al.  
Attorney Docket No. 1935-00166

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2/5

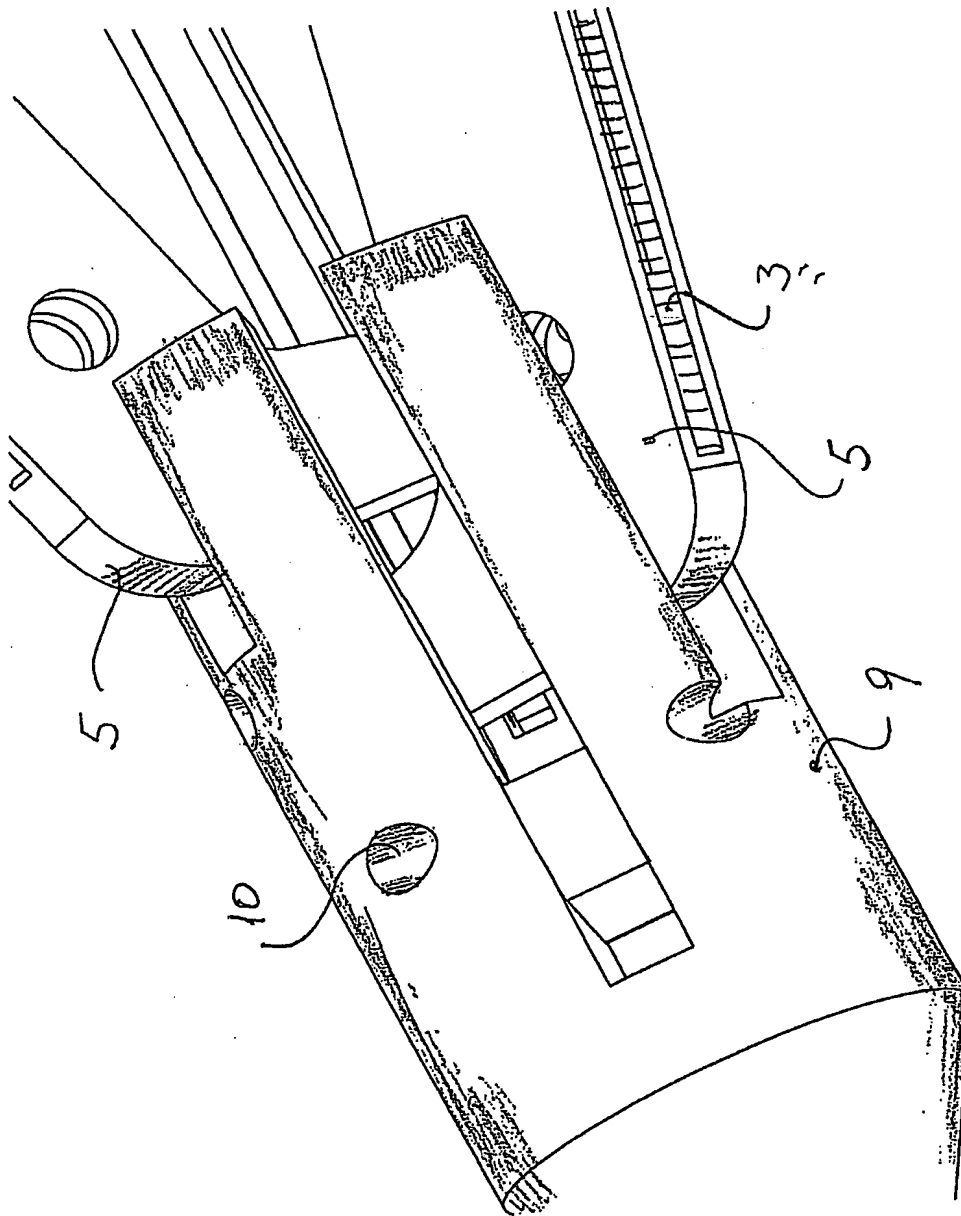


Fig. 4

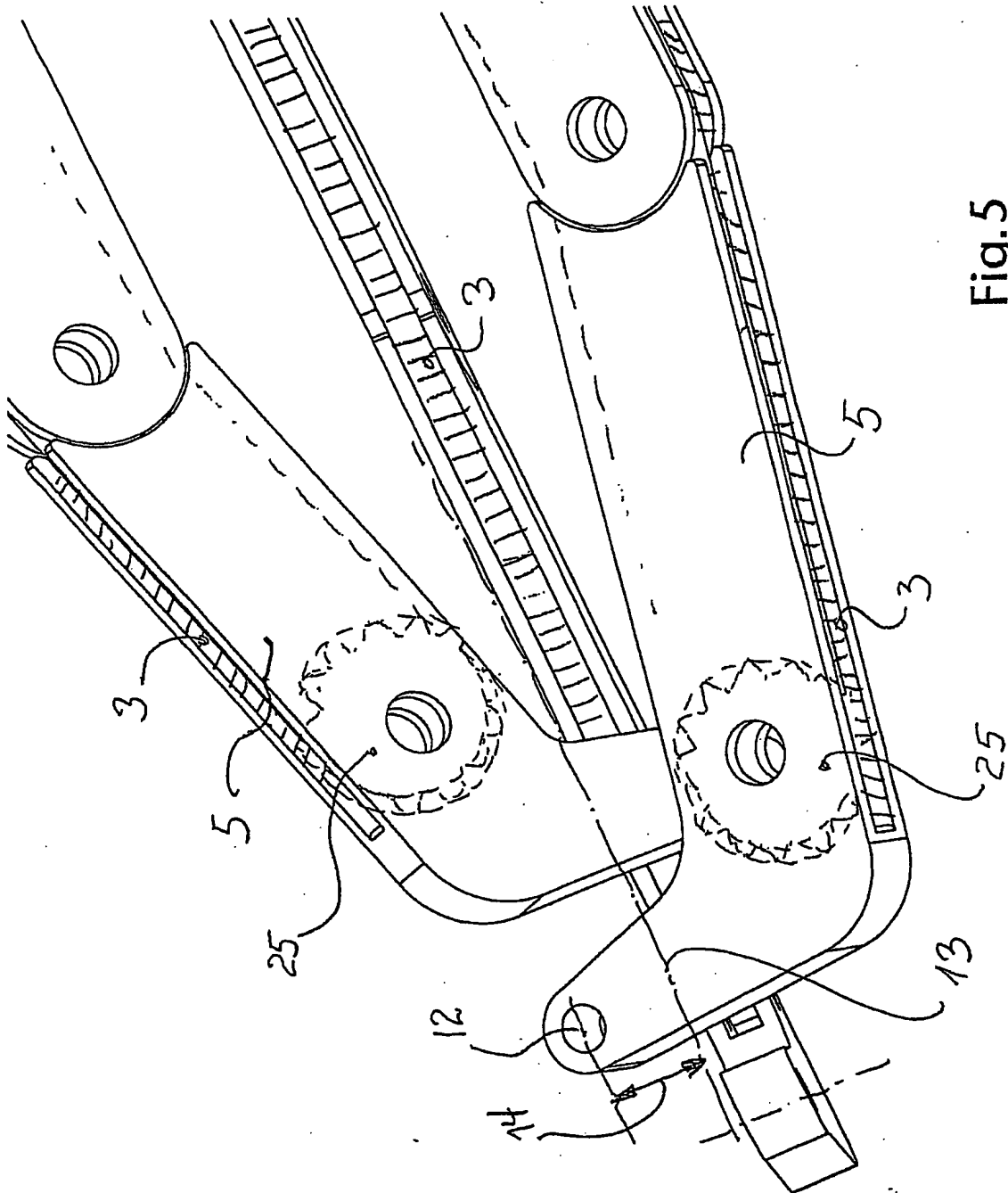


A DEVICE FOR A PULLING TOOL FOR USE IN PIPES AND BOREHOLES  
FOR THE PRODUCTION OF OIL AND GAS (as amended)

Inventor(s): Geir Ueland et al.  
Attorney Docket No. 1935-00166

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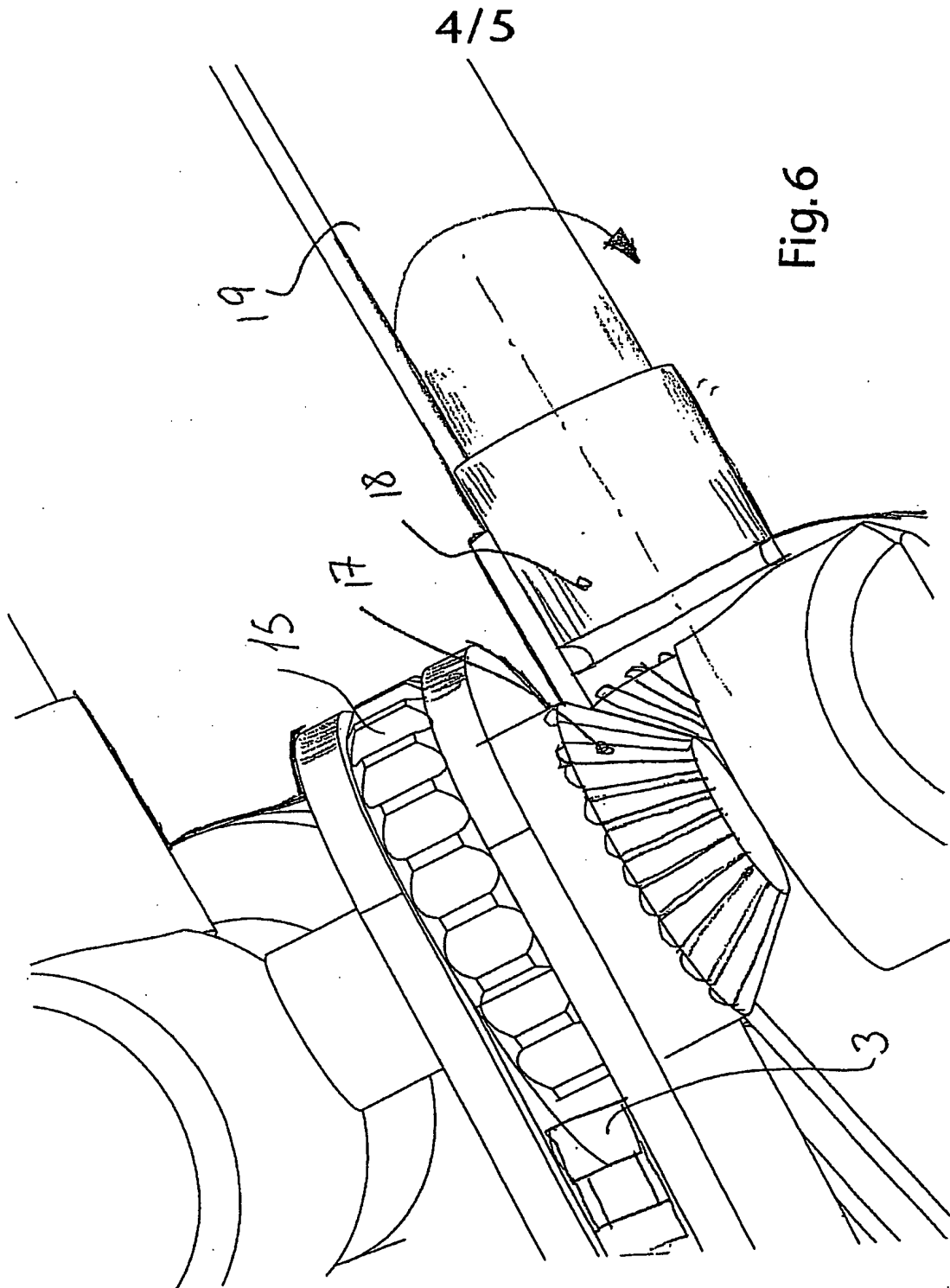
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A DEVICE FOR A PULLING TOOL FOR USE IN PIPES AND BOREHOLES  
FOR THE PRODUCTION OF OIL AND GAS (as amended)

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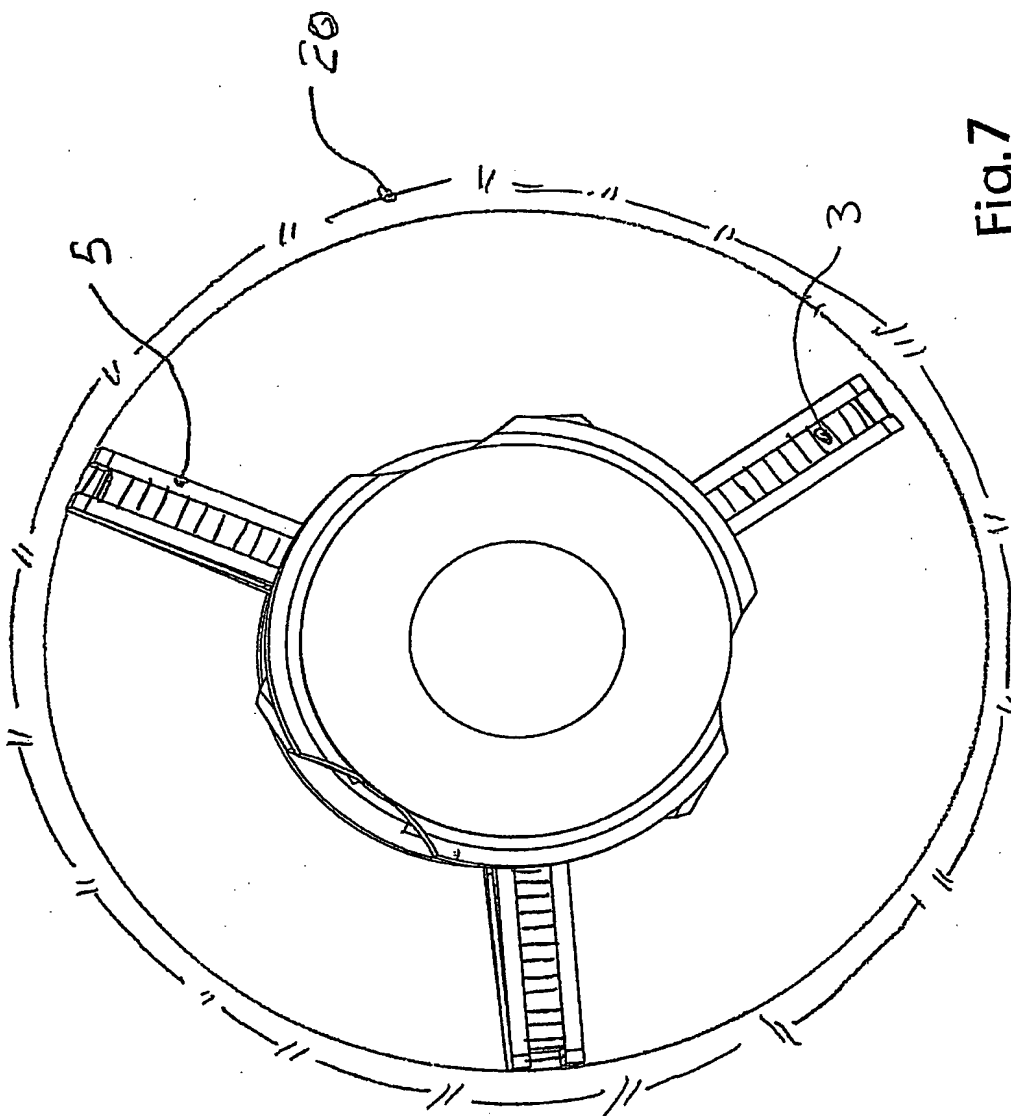


A DEVICE FOR A PULLING TOOL FOR USE IN PIPES AND BOREHOLES  
FOR THE PRODUCTION OF OIL AND GAS (as amended)

Inventor(s): Geir Ueland et al.  
Attorney Docket No. 1935-00166

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5/5



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 2004/000022

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: E21B 23/00, F16L 55/28

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: E21B, F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2742259 A (C.E. BOUCHER), 17 April 1956 (17.04.1956), whole document	1,2
Y	--	3
X	US 4670862 A (P. STARON ET AL), 2 June 1987 (02.06.1987), whole document	1,2
Y	GB 109021 A (J.E. GLEASON ET AL), 30 August 1917 (30.08.1917), whole document	3
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☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search <b>31 August 2004</b>	Date of mailing of the international search report <b>08-09-2004</b>
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer  <b>Christer Bäcknert / MRO</b> Telephone No. +46 8 782 25 00

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

31/07/2004


International application No.

PCT/NO 2004/000022

US	2742259	A	17/04/1956	NONE		
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US	4670862	A	02/06/1987	AU	571646 B	21/04/1988
				AU	3865385 A	22/08/1985
				BR	8500731 A	08/10/1985
				CA	1228910 A	03/11/1987
				DE	3561084 D	00/00/0000
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				NO	850601 A	19/08/1985
				OA	7954 A	31/01/1987
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GB	109021	A	30/08/1917	NONE		
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## PCT REQUEST

Original (for SUBMISSION)

0	For receiving Office use only	PCTNO 04 00022
0-1	International Application No.	
0-2	International Filing Date	26 JAN. 2004 (26.01.04)
0-3	Name of receiving Office and "PCT International Application"	 <b>PATENTSTYRET</b> <small>Statens forordningsmyndighet</small> PCT International Application
0-4	Form - PCT/RO/101 PCT Request	
0-4-1	Prepared Using	PCT-SAFE [EASY mode] Version 3.50 (Build 0002.150)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	Norwegian Patent Office (RO/NO)
0-7	Applicant's or agent's file reference	P 24508 PC
I	Title of Invention	A PULLING TOOL DEVICE FOR USE IN TUBULARS AND BOREHOLES FOR OIL- AND GAS PRODUCTION
II	Applicant	
II-1	This person is:	applicant only
II-2	Applicant for	all designated States except US
II-4	Name:	CHAIN TRAIN
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II-6	State of nationality	NO
II-7	State of residence	NO
III-1	Applicant and/or inventor	
III-1-1	This person is:	applicant and inventor
III-1-2	Applicant for	US only
III-1-4	Name (LAST, First)	UELAND, Geir
III-1-5	Address:	Nonsberggtunet 11 4050 SOLA Norway
III-1-6	State of nationality	NO
III-1-7	State of residence	NO

## PCT REQUEST

Original (for SUBMISSION )

III-2	Applicant and/or inventor	applicant and inventor
III-2-1	This person is:	US only
III-2-2	Applicant for	US only
III-2-4	Name (LAST, First)	MELLEMSTRAND, Jone
III-2-5	Address:	Solavegen 513 4354 VOLL Norway
III-2-6	State of nationality	NO
III-2-7	State of residence	NO
IV-1	Agent or common representative; or address for correspondence The person identified below is hereby/ has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name:	HÅMSØ PATENTBYRÅ ANS
IV-1-2	Address:	P.O. Box 171 4302 SANDNES Norway
IV-1-3	Telephone No.	+47 51 66 20 20
IV-1-4	Facsimile No.	+47 51 66 18 96
IV-1-5	e-mail	patent@hamso.no
V	DESIGNATIONS	
V-1	The filing of this request constitutes under Rule 4.9(a), the designation of all Contracting States bound by the PCT on the international filing date, for the grant of every kind of protection available and, where applicable, for the grant of both regional and national patents.	
VI-1	Priority Claim	NONE
VII-1	International Searching Authority Chosen	Swedish Patent Office (ISA/SE)
VII-2	Request to use results of earlier search; reference to that search	
VII-2-1	Date	28 October 2003 (28.10.2003)
VII-2-2	Number	20024227
VII-2-3	Country (or regional Office)	NO

## PCT REQUEST

Original (for SUBMISSION )

<b>VIII</b>	<b>Declarations</b>	<b>Number of declarations</b>	
VIII-1	Declaration as to the identity of the inventor	-	
VIII-2	Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent	-	
VIII-3	Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application	-	
VIII-4	Declaration of inventorship (only for the purposes of the designation of the United States of America)	-	
VIII-5	Declaration as to non-prejudicial disclosures or exceptions to lack of novelty	-	
<b>IX</b>	<b>Check list</b>	<b>number of sheets</b>	<b>electronic file(s) attached</b>
IX-1	Request (including declaration sheets)	4	-
IX-2	Description	2	-
IX-3	Claims	1	-
IX-4	Abstract	1	✓
IX-5	Drawings	5	-
IX-7	TOTAL	13	
	<b>Accompanying Items</b>	<b>paper document(s) attached</b>	<b>electronic file(s) attached</b>
IX-8	Fee calculation sheet	✓	-
IX-9	Original separate power of attorney	✓	-
IX-17	PCT-SAFE physical media	-	✓
IX-19	Figure of the drawings which should accompany the abstract	5	
IX-20	Language of filing of the international application	Norwegian	
X-1	Signature of applicant, agent or common representative		
X-1-1	Name (LAST, First)	HÅMSØ PATENTBYRÅ ANS Gunnar Håmsø Attorney at Law	
X-1-2	Name of signatory		
X-1-3	Capacity		